invention, one or more characteristics of the fluidic droplets, and/or a characteristic of a portion of the fluidic system containing the fluidic droplet (e.g., the liquid surrounding the fluidic droplet) can be sensed and/or determined in such a manner as to allow the determination of one or more characteristics of the fluidic droplets, for example, using one or more sensors. Characteristics determinable with respect to the droplet and usable in the invention can be identified by those of ordinary skill in the art. Non-limiting examples of such characteristics include fluorescence, spectroscopy (e.g., optical, infrared, ultraviolet, etc.), radioactivity, mass, volume, density, temperature, viscosity, pH, concentration of a substance, such as a biological substance (e.g., a protein, a nucleic acid, etc.), size, shape, color, or the like. In some cases, a fluidic droplet may be screened and/or sorted based on this determination.

[0097] As a specific example, a characteristic of a species present within a fluidic droplet (for example, one or more signaling entities, such as those previously described) may be determined in some fashion, and the fluidic droplet screened and/or sorted on the basis of the determination. For instance, the fluidic droplet may contain a cell such as a hybridoma or an antibody-producing cell, and the signaling entity may indicate the presence, concentration, binding activity, catalytic activity, regulatory activity, etc., of a species expressed by the cell, for example, a protein, peptide, nucleic acid, antibody, enzyme, hormone, etc. The fluidic droplet can then be selected or screened on the basis of this determination. As another example, a fluidic droplet may contain a human blood cell, and the fluidic droplet may be selected or screened on the basis of the presence, concentration, etc. of a desired antibody. For example, the fluidic droplet may be directed to a first location (e.g., for further analysis or culture) if the species is present within the fluidic droplet, and to a second location (e.g., to be discarded) if the species is not present within the fluidic droplet, or is present but at an unacceptable level, concentration, configuration, etc. The fluidic droplets may also be further processed, for example, breaking up the fluidic droplet, lysing cells within the droplet, killing cells within the droplets, coalescing the droplets into larger droplets, splitting the droplets into smaller droplets, removing or extracting species from the droplet, adding additional species to the droplet, or the like.

[0098] In some systems, such as microfluidic systems, that involve sensing, a sensor may be connected to a processor, which in turn, can cause an operation to be performed on the fluidic droplet, for example, by sorting the droplet, adding or removing electric charge from the droplet, fusing the droplet with another droplet, splitting the droplet, causing mixing to occur within the droplet, etc., for example, as previously described. For instance, in response to a sensor measurement of a fluidic droplet, a processor may cause the fluidic droplet to be split, merged with a second fluidic droplet, etc.

[0099] One or more sensors and/or processors may be positioned to be in sensing communication with the fluidic droplet. "Sensing communication," as used herein, means that the sensor may be positioned anywhere such that the fluidic droplet within the fluidic system (e.g., within a channel), and/or a portion of the fluidic system containing the fluidic droplet may be sensed and/or determined in some fashion. For example, the sensor may be in sensing communication with the fluidic droplet and/or the portion of the fluidic system containing the fluidic droplet fluidly, optically or visually, thermally, pneumatically, electronically, or the like. The sensor can be positioned proximate the fluidic system, for example, embedded within or integrally connected to a wall of a channel, or positioned separately from the fluidic system but with physical, electrical, and/or optical communication with the fluidic system so as to be able to sense and/or determine the fluidic droplet and/or a portion of the fluidic system containing the fluidic droplet (e.g., a channel or a microchannel, a liquid containing the fluidic droplet, etc.). For example, a sensor may be free of any physical connection with a channel containing a droplet, but may be positioned so as to detect electromagnetic radiation arising from the droplet or the fluidic system, such as infrared, ultraviolet, or visible light. The electromagnetic radiation may be produced by the droplet, and/or may arise from other portions of the fluidic system (or externally of the fluidic system) and interact with the fluidic droplet and/or the portion of the fluidic system containing the fluidic droplet in such as a manner as to indicate one or more characteristics of the fluidic droplet, for example, through absorption, reflection, diffraction, refraction, fluorescence, phosphorescence, changes in polarity, phase changes, changes with respect to time, etc. As an example, a laser may be directed towards the fluidic droplet and/or the liquid surrounding the fluidic droplet, and the fluorescence of the fluidic droplet and/or the surrounding liquid may be determined. "Sensing communication," as used herein may also be direct or indirect. As an example, light from the fluidic droplet may be directed to a sensor, or directed first through a fiber optic system, a waveguide, etc., before being directed to a sensor.

[0100] Non-limiting examples of sensors useful in the invention include optical or electromagnetically-based systems. For example, the sensor may be a fluorescence sensor (e.g., stimulated by a laser), a microscopy system (which may include a camera or other recording device), or the like. As another example, the sensor may be an electronic sensor, e.g., a sensor able to determine an electric field or other electrical characteristic. For example, the sensor may detect capacitance, inductance, etc., of a fluidic droplet and/or the portion of the fluidic system containing the fluidic droplet.

[0101] As used herein, a "processor" or a "microprocessor" is any component or device able to receive a signal from one or more sensors, store the signal, and/or direct one or more responses (e.g., as described above), for example, by using a mathematical formula or an electronic or computational circuit. The signal may be any suitable signal indicative of the environmental factor determined by the sensor, for example a pneumatic signal, an electronic signal, an optical signal, a mechanical signal, etc.

[0102] In still another aspect, the invention provides systems and methods for screening or sorting fluidic droplets in a liquid. Sorting can be accomplished, in some instances, based on the content of a drop (e.g., based on how many particles or cells it contains). In some embodiments, suspensions of aqueous droplets in oil can be prepared that contain a precise number (e.g., one and only one) of particles (e.g., cell, bead, and/or any other particle).

[0103] For example, a characteristic of a droplet may be sensed and/or determined in some fashion, then the droplet may be directed towards a particular region of the device, for example, for sorting or screening purposes. For instance, an electric field may be applied or removed from the fluidic droplet to direct the fluidic droplet to a particular region (e.g. a channel). In some cases, high sorting speeds may be achievable using certain systems and methods of the invention. For instance, at least about 10 droplets per second may be deter-